

JOINT EVENT

5<sup>th</sup> World Conference on **Climate Change**

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16<sup>th</sup> Annual Meeting on**Environmental Toxicology and Biological Systems**October 04-06, 2018  
London, UK**Climate warming shifts Indian monsoon season: Evidence from observation****Elena Surovyatkina**

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**Statement of the Problem:** The Indian summer monsoon is the season of rain. The economy of India can maintain its GDP in the wake of a good monsoon. However, if monsoon gets delayed by even two weeks, it can spell disaster because of the high population depending on agriculture—70% of its people are directly related to farming. In Central India, the variability of monsoon is quite high due to local changes such as rapid urbanization and industrialization. The forecasting of climate phenomena on a seasonal scale is a challenge, mostly because there is no recent historical precedent for such change in the climate system.

**Methodology & Theoretical Orientation:** We forecasted monsoon using our recently developed methodology, which is based on the theory of critical transitions. Our predictions rely on observations of near-surface air temperature and relative humidity from both the ERA-40 and NCEP/NCAR re-analyses. We performed our forecasts for the onset and withdrawal of monsoon for the Central part of India.

**Findings:** It was revealed that climate change affects the Indian summer monsoon in two aspects: in the last decade, the intensity of monsoon rainfalls in the Central part of India has increased, and the onset and withdrawal of the monsoon have been delayed. This is due to an increase in spring temperatures and a slower cooling in autumn that is linked to global warming. The novel approach allows accounting climate change effects and predicting the monsoon onset and withdrawal dates for 40 and 70 days in advance, respectively. The results show that our method allows predicting the monsoon not only retrospectively, but also in the future: in 2016 and 2017 both of our forecasts were successful. Hence, we proved that such early prediction of the monsoon timing is possible even under the conditions of climate change.

**Recent Publications**

1. Tony J, Subarna S, Syamkumar K S, Sudha G, Akshay S, et al. (2017) Experimental investigation on preconditioned rate induced tipping in a thermoacoustic system. *Scientific Reports–Nature* 7(1):5414.
2. Stolbova V, Surovyatkina E, Bookhagen B and Kurths J (2016) Tipping elements of the Indian monsoon: prediction of onset and withdrawal. *Geophys. Res. Lett.* 43:1–9.
3. Apala Majumdar, John Ockendon, Peter Howell and Elena Surovyatkina (2013) Transitions through critical temperatures in nematic liquid crystals. *Phys. Rev. E.* 88: 022501.
4. Surovyatkina E D, Kravtsov Yu A and Kurths J (2005) Fluctuation growth and saturation in nonlinear oscillator on the threshold of bifurcation of spontaneous symmetry breaking. *Phys. Rev. E* 72:046125.
5. Surovyatkina E D (2004) Phenomenon of prebifurcation rise and saturation of the correlation time. *Physics Letters A* 329(3):169–172.

**Biography**

Elena Surovyatkina has her expertise in Theoretical Physics in the field of Theory of Critical Phenomena. She has contributed to the understanding of critical transitions with the new theory of nonlinear pre-bifurcation noise amplification and rate-depended phenomena. She discovered a new phenomenon of overcooling and overheating of critical temperatures in liquid crystals. Currently, her research is devoted to the spatially organized critical transitions in climate. The most significant contribution in climate dynamics is a new methodology of the earliest forecast of the Indian summer monsoon.

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